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KSC ESTIMATING FORMAT FOR CM  
KENNEDY SPACE CENTER CONSTRUCTION COST ENGINEERING FORMAT FOR  
SPACE SHUTTLE FACILITIES CONSTRUCTION MANAGEMENT

7N-81-7M  
190586

JOSEPH ANDREW BROWN CCE  
CHAIRMAN 1975 AACE ANNUAL MEETING  
CONSULTANT CONSTRUCTION COST ENGINEER  
MERRITT ISLAND, FLORIDA 32952

NASA CONSTRUCTION COST ENGINEER  
DESIGN ENGINEERING DIRECTORATE, DD-FED-1  
NATIONAL AERONAUTICS & SPACE ADMINISTRATION  
KENNEDY SPACE CENTER, FLORIDA 32899

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## INTRODUCTION

This presentation describes NASA Budget; PER's (Preliminary Engineering Reports, Preliminary and Final Design [30, 60, 90, 100%] Cost Estimates); also modification Change Orders Cost Estimate. Some of its special features include one page unique summaries for (1) subcontractor's labor and material, (2) systems, and (3) specialized (Aerospace) construction budget line items. It discusses basic concepts in construction cost management, cost engineering, value engineering, and the KSC Monthly Cost Index. The 60 viewgraphs of samples and descriptions serve as an orientation for NASA Management, Project Engineers, and Designer; Architect/Engineers, A&E Designer Engineers and Estimators and KSC in-house support contractors, PRC Engineers, Designers and Estimators. This method is important to help standardize the construction cost estimating procedures for construction management with over 370 KSC design engineers (DE), 900 PRC support contractor engineers, technicians, and 10 to 18 A&E firms handling over 100 separate projects for Space Shuttle Facilities, Ground Support Equipment, and Payloads Receiving Check-out Launches. These Shuttle facilities are for near space developments for mankind, such as communication satellites, manufacturing, energy management, and defense. This standardized format will reduce KSC reviews and approval time of cost estimates, reduce engineering design and redesign time, improve accuracy and credibility of estimates and strengthen the Government's negotiation position.

## BACKGROUND FOR KSC SPEC-G-0002, THE KSC COST ESTIMATING SPECIFICATION

The need for the specification stems from:

- a. The inexactness of the estimating science.
- b. The lack of uniformity in the methods used by preparing organizations to compile, present, and support costs in estimates submitted for KSC Construction of Facilities (CoF) projects.
- c. The lack of unit price bids and adequate contractor feedback.
- d. Problems of specialized construction - GSE (Ground Support Equipment).

Currently, submitted CoF estimates vary greatly in completeness, accuracy, and costs presentation and traceability. The time required to review and rework these estimates is increasing and impacting project schedules.

## THE KSC ESTIMATING SPECIFICATION

The KSC cost estimating specification establishes uniformity in cost estimate compilation by specifying requirements and guidelines for use by all preparing organizations. The specification will:

- a. Reduce KSC review and approval time - by defining how construction costs are to be compiled and supported, and where these costs are to appear in estimate submittal packages
- b. Reduce engineering design and redesign time -by requiring that estimate submittals include cost analyses, value and cost engineering data, and cost summaries for timely identification of potential project savings, overruns, and scope changes
- c. Improve the accuracy and credibility of estimates - by requiring detailed breakdowns of labor, material, and markup costs and the verification of estimated costs by direct quotes and approved reference publications.
- d. Strengthen the Government's negotiating position - with requirements oriented toward timely development of accurate and realistic construction cost estimates

Requirements and guidelines in the specification are based on experience with current and past CoF projects and establish:

- e. Consistency in estimating practices, methods, and cost presentation used by preparing organizations
- f. Systematic approaches to developing and projecting CoF project costs

Consistent practices and systematic cost development are fundamental elements of timely and effective construction cost management, value engineering, and cost engineering. Thus, implementation of the estimating specification forms the foundation for cost effective assessment and maintenance of CoF project costs.

#### USES

Cost estimates are basic controlling factors in KSC CoF projects from the design concept phase through facility activation. Accurate and realistic cost estimates are key factors in:

- a. Cost effective construction cost management
- b. Establishing budgets for future projects
- c. Preparing requests for Government funding
- d. Determining the fairness and reasonableness of contractor bids and proposals

- e. Reviews for project cost reductions, cost analyses, and value engineering proposals
- f. Project planning, scheduling, critical path method (CPM), analyses, and fast tracking
- g. Evaluating contractor requests for payment
- h. Evaluating and negotiating contractor's claims and Government change orders

#### TYPES

Eight different types of cost estimates are used at KSC. Each type relates to a specific phase of CoF project as follows:

- Code A1 Budget Cost Estimate-is the initial determination of the project scope that can be completed for a stipulated monetary amount. It serves as a basis for overall program planning and control, for establishing equitable design agency fees, and for comparative cost analyses. Normally, this estimate is compiled on KSC form 1510 and accompanies requests for facilities that are forwarded to NASA Headquarters.
- Code A2 Preliminary Engineering Report Estimate - incorporates the information needed to formulate a facility design, including the bases for requirements, analyses of facility functions or work, option evaluations and recommendations, and other factors. This estimate provides key criteria for Headquarters funding allocations and design authorizations. KSC form 21-193 is used for compiling Code A2 estimated costs.
- Code B Labor and Material Unit Cost Estimate - is normally used during the initial stages of facility design, but not beyond the 49 percent completion point. Labor and material costs are combined and presented as single unit costs in KSC form 21-224.
- Code C Detailed Construction Cost Estimate- shows separated costs for labor and materials with a high degree of detail. Unless otherwise specified, Code C estimates are prepared for 30-, 60-, and 90 percent design reviews using KSC form 21-243.
- Code C-95 Construction Cost Estimate- incorporates changes and comments approved during a 90 percent design review and reflects the final estimated cost of the project design. This estimate represents the anticipated project bid cost based on percent design.
- Code C -100 Construction Cost Estimate- often called the final or Government estimate. It is a C-95 estimate to which costs for bid documentation, amendments, and special conditions have been added.

Code D Contract Change Order Cost Estimate - determines costs of proposed changes and supplemental work to existing contracts and is used to negotiate additions, deletions, or both, of project work.

Code E Cost Estimate - is compiled as specified by NASA/KSC to support special studies, surveys, program analyses, and effective construction cost management.

#### PREPARING ORGANIZATIONS

Any or all of these estimate codes can be compiled by personnel in NASA/KSC, architectural and engineering (A&E), and in-house support contractor organizations. The KSC cost estimating specs provides these organizations with standard requirements and guidelines covering three basic areas of cost estimate development:

- a. Estimator qualifications and responsibilities.
- b. Organizational interfaces and responsibilities involved in the preparation submittal, review, and approval of cost estimate.
- c. Compilation, presentation, and submittal packaging of estimated costs.

#### ESTIMATOR QUALIFICATIONS

Cost estimates for KSC CoF projects must reflect working knowledge and experience in estimating practices that are standard in the industry. Additionally, and because estimating is an inexact science, these estimates should incorporate new innovations, techniques, and pricing guidelines that have proven to be successful. For these reasons, the KSC cost estimating specification strongly recommends that estimators have at least one of the following qualifications:

- a. Full membership in the American Association of Cost Engineers (AACE) or the American Society of Professional Estimators (ASPE).
- b. Two years of college level engineering and 7 years of full time experience in professional construction cost estimating.
- c. Certification as a cost engineer.

Furthermore, the specification requires that, within preparing organizations, other persons as professionally competent as the estimators shall review and check cost estimates prior to submittal. Estimators and checkers must sign and date each sheet of the estimate

## ORGANIZATIONAL INTERFACES AND RESPONSIBILITIES

Defined responsibilities and procedures for NASA/KSC organizations are based on the latest revision to Design Engineering Operating Concept. They are oriented to timely and cost effective development, review, and approval of cost estimates for any and all stages of CoF projects.

An ideal representation of NASA/KSC organizational responsibilities shows the Lead Designer or Project Engineer as the single point interface between organizations preparing cost estimates and NASA/KSC organizations charged with:

- a. Establishing project design requirements and budgets (project and system engineers).
- b. Establishing general criteria for Government cost estimates, such as percentages to be used for markups and general conditions, and standard labor and material costs as published in the KSC Construction Cost Index (DD-FED Cost Engineering Unit).
- c. Project value engineering, cost engineering, and construction cost management (Estimating Unit/in-house contractor).
- d. Reviewing, evaluating, and approving cost estimates (Project Engineer, DD-FED Cost Engineering Unit, and in-house contractor).

### LEAD DESIGNER

Normally, the Lead Designer is the highest level project representative in direct communication with organizations preparing cost estimates during the project design phase. He schedules and coordinates the preparation, submittal, review, and approval of construction cost estimates. The Lead Designer coordinates resolution of conditions or situations not covered in the cost estimating specification and assures that preparing organizations incorporate changes in estimates as required for NASA/KSC approval.

### KSC COST ENGINEERING

The Cost Engineering Unit supports the Lead Designer by providing updated information concerning cost engineering and estimating, including percentages to be used for contractor overhead, PT&I, contingencies, and other costs generally applicable to cost estimates. The Cost Engineering Unit also coordinates reviews and critiques of cost estimates by the in-house contractor as required. Finally, the Cost Engineering Unit is the NASA/KSC technical contact for preparation and maintenance of the Construction Cost Index, Abstract of Construction Bid Costs, and Design Cost Study by the in-house support contractor.

### THE IN-HOUSE SUPPORT CONTRACTOR

In addition to preparing estimates, the designated in-house contractor is to:

- a. Maintain copies of pertinent regulations, reference books, publications, etc for use in preparing and reviewing estimates and for keeping abreast of current pricing.
- b. Review and advise, as authorized, cost estimates prepared by others; document and forward to the DD-FED Cost Engineer comments and recommendations concerning areas favorable to cost reductions or not conforming to specification requirements.
- c. Prepare the KSC Construction Cost Index, Design Cost Study, and Abstract of Construction Bid Costs.
- d. Prepare critiques of Government estimates that vary by 10 percent or more from bids received from private contractors.
- e. Review and approve all cost estimates prepared by in-house contractor personnel for conformance to the specification prior to submittal to NASA/KSC.

The in-house support contractor will use the Construction Cost Index, Design Cost Study, Abstract of Construction Bid Costs, and other material to perform cost and value engineering services as authorized.

#### COMPILATION, PRESENTATION, AND PACKAGING OF ESTIMATED COSTS

Requirements and examples in the cost estimating specification cover pricing practices, cost presentations, and packaging for each type of estimate used at KSC. In summary, this coverage provides:

- a. Uniform cost estimating practices and pricing presentations. This uniformity enables rapid and accurate assessment of project status in terms of funding, cost rise factors, and comparison with other projects of comparable scope and complexity.
- b. Project cost summaries for early identification of potential cost overruns or underruns, scope revisions, and redesign.
- c. Increased accuracy and traceability of estimated costs by mandating detailed cost breakdowns and submittal of source data and pricing computations.

#### COMPILATION

##### BASIC ESTIMATING PRACTICES

Compilation requirements in the estimating specification for all CoF estimates are summarized as follows:

- a. Estimates shall be broken down in as much detail as possible. The greater the estimated cost, the greater the detail required.

- b. Cost estimates for all codes shall be prepared by using estimating practices standard throughout the industry and in the same careful manner as if NASA/KSC were bidding in competition with other prudent, experienced, and well-equipped private contractors.
- c. Estimated costs shall be based on prices obtained from approved sources. All major labor and materials prices shall be confirmed by companies bidding work local to the job site. Army Manual(TM-5-800-2) units of measure will be used throughout.
- d. Estimates shall cover all work shown or implied on the plans, specifications, and other pertinent documents.
- e. Lump sums shall not appear in the estimate. Cost totals shall be rounded off to the nearest dollar.
- f. Mechanical and electrical labor shall be estimated in manhours.
- g. All estimates shall be summarized with building square-foot costs and systems summaries by units using the NASA Computerized Specification Divisional (SPECSINTACT) format.
- h. Cost estimate submittals shall consist of pencil originals and four legible, dry -type copies forwarded through the cognizant KSC Lead Designer. Typed originals become smeared and illegible when undergoing correction or revisions. Copies of blank KSC forms is discouraged.
- i. On all Code B, C, and D estimates, structural steel shall be taken off and summarized by kinds and types in detailed cost breakdown sheets provided for each kind and type.
- j. Direct quotations shall be obtained from KSC-approved sources when no published prices are available, to verify estimated prices, for unusual applications of products and equipment, and for custom fabrication of products and equipment. These quotations shall be used solely for verification of estimated prices, but not in lieu of estimated prices.

## ESTIMATING GENERAL CONSTRUCTION, MECHANICAL, AND ELECTRICAL WORK

### GENERAL CONSTRUCTION

For all estimate codes except A1, estimated costs for general construction labor, material, equipment, and markups will be identified in appropriate site work, Architectural/Structural, Interior Mechanical/Electrical, and Exterior Utilities portions of the estimate.

For structural steel, mill costs, shop fabrication costs (on-and off-site),



and erection costs will be estimated in clarity and detail by type and size.

Concrete work will be broken down into slabs, walls, footings, aprons, and other categories. Reinforcing steel will be listed and priced by type and size.

For major facility equipment, furnished as part of the job, costs for the equipment and the labor, materials, and markups associated with its installation will be identified.

#### ESTIMATING PERFORMANCE SPECIFICATIONS AND GOVERNMENT FURNISHED EQUIPMENT (GFE)

##### PERFORMANCE SPECIFICATION

Performance specifications referenced in the plans or specifications will be estimated in detail.

Examples: Fire protection sprinkler systems  
Cranes  
Halon systems

Estimators will provide detailed breakdowns of system costs by developing layout drawings of the system proposed for the project or from suitable drawings in the performance specification.

Developed layout drawings will be submitted with the estimate. Suitable sample drawings will be identified in the estimate with source date.

In the sprinkler system example, the system is laid out by room, with sprinkler heads, valves, hangers, etc., clearly indicated by type and location.

Labor, material, and markup costs for the system will be taken off in detail and inserted in the proper SPECSINTACT section in the estimate.

##### GFE

GFE is priced by one of two methods. In method 1, for substantial quantities, GFE items are listed and priced on KSC form 19-75 inserted at the end of the trades summaries. Contractor labor and material costs for each item are carried forward to appropriate divisional trades summary sheets, clearly identified, marked up along with costs of non-GFE items, and referenced forwards and backwards.

In method 2, for minimal quantities, GFE items and associated contractor costs, clearly identified, appear with non-GFE items in divisional trades summary sheets. On a separate sheet at the end of the trades summaries, estimated values and quantities of all project GFE are listed, totalled, and referenced forwards and backwards.

Trades summary GFE costs cover contractor handling, transportation, installation, waste, testing, shop drawings, refurbishment, and other costs and are normally percentages of GFE values.

## ESTIMATING SPECIALIZED CONSTRUCTION, WITHHELD WORK, AND ALTERNATES

### SPECIALIZED CONSTRUCTION

Because of the specialized nature of NASA/KSC activities, facility projects often require construction of exotic systems, such as hypergolic fuel distribution, which are not normally encountered in routine construction projects.

The Lead Designer will identify specialized construction for estimators. Work involved with specialized construction will then be estimated as if it were a separate CoF project, with costs organized and presented in civil, architectural/structural, mechanical, and electrical portions.

Labor costs may be impacted by health and safety factors peculiar to specialized construction, such as heights, toxic gases and fluids, and radiation.

Fabrication, cleaning, and testing to extremely close tolerances will also influence labor costs.

Material costs can be impacted by GFE requirements, close tolerances, high reliability design, and waste.

Markups for specialized construction will be organized and identified as shown in the illustrated checklist.

### COST PRESENTATION

The cost estimating specification provides requirements and examples of how and where estimated costs are to appear in each type of CoF estimate. The resultant uniformity will facilitate early and rapid assessment of project status in every stage of project development.

Cost presentations will be in two orientations:

- a. Project Summaries
- b. Trades Summaries

### PROJECT SUMMARIES

The specification defines five project summaries that will provide overviews of CoF project areas having major impact on funding allocations. These summaries are:

- a. The Estimated Construction Bid Cost (ECBC) Summary - Presents the total cost and cost by SPECSINTACT division for constructing the project to the latest design plans and specifications.
- b. Labor and Material Cost Summary - Indicates labor, material, and

markup cost totals for civil, architectural/structural, mechanical, electrical, and specialized construction portions of the project.

- c. Comparison of Budgeted and Estimated Costs - indicates and analyzes departures of estimated costs from costs budgeted for the project.
- d. Systems Summary of Government Estimate - indicates and relates per-unit and total project costs to project design descriptions and physical features.
- e. Special Conditions Summary - indicates the costs of imposing bid documents and contractual conditions that govern project construction.

#### ECBC SUMMARY

This summary identifies cost totals for six construction categories common to all CoF projects, as well as the total cost of these categories, that have been estimated from latest design drawings and specifications. These costs will be organized and presented as follows:

Part I, Site Work -Summarizes estimated costs for SPECSINTACT division 2.

Part II, Building/Structural, Interior - Summarizes estimated costs for work inside the 5-ft line (SPECSINTACT division 3 through 16).

Part III, Utilities - Summarize estimated costs for work outside the 5-ft line (primarily SPECSINTACT division 15 and 16).

Part IV, Specialized Construction - Summarizes estimated costs of KSC specialized work.

Part V, Withheld Work Allowance - Summarizes work withheld from final design, requests for bids, or contract award.

Part VI, Alternates - Summarizes estimated costs for alternate work.

#### SPECIAL CONDITIONS SUMMARY

This summary indicates costs associated with the imposition of bid documents and contractual conditions under which project work will be performed, such as:

- a. Joint occupancy (JO) and beneficial occupancy (BO).
- b. Accelerations

- c. Downtime
- d. Minorities and subcontractor premiums
- e. Delayed construction
- f. Escalation
- g. Documentation, instructions, and operations and maintenance manuals for new systems.

#### CODE A1 COST PRESENTATION

Code A1 Budget Cost Estimates are normally prepared on KSC form 1510 when intended for delivery to NASA Headquarters. In sheet 2 of this form, the engineering estimate is compiled in unit costs combining labor, material, and markups involved in:

- Item (1) Interest in Real Estate
- Item (2) Site Development & Utilities Outside the 5-foot line
- Item (3) Architectural/Structural, Mechanical, and Electrical inside the 5-ft line
- Item (4) Other Collateral Equipment not Included in (3) above
- Item (5) Special Features

Source data (item 7) must be identified by title and publication date.

Cost compilation and definitions of specific items to be included in items 1 through 5 should conform to those used in NASA Management Instruction (NMI 7330.2) for Code A2 Preliminary Engineering Report (PER) estimates.

The budget cost for each PER code item is derived by applying the following factors to the estimated engineering costs:

$$\text{Budget Estimate} = E(1+F)(1+G)(1+C)$$

Where: E is the engineering estimate

C is the contingency factor

F is the cost rise factor

G is the outside agency administrative cost factor.

Cost for preparing final design drawings and specifications must not be included in form 21-193. Instead, they are to be presented under paragraph E, costs not in estimate.

These costs are to be broken down and presented as shown in the illustrated example.

Outside agencies indicated in the estimate are to be identified as well as the agency activities to which estimate costs apply.

#### CONSTRUCTION COST MANAGEMENT

Effective construction cost management involves overviewing, recording, manipulating, and analyzing all project costs funding or allowances to assure conformance to budgetary constraints and the highest return on owner investment. It begins at the earliest phase of project planning and continues through construction. An optimum cost management program strives to:

- a. Establish realistic project budgets through thorough analyses of program requirements and the market environment local to the project site.
- b. Achieve an optimum balance of project values so that individual building systems and elements relate vis-a-vis cost, function, building life, and building maintainability for lowest life cycle costs.
- c. Retain planning flexibility through creation of project cost models that reflect each major design decision and the cost significance of decisions.
- d. Exercise desirable contracting options, fast-tracking, contract phasing, multiple prime contractors, negotiated contracts, etc., through sensitive control of project cost elements and by maintaining design flexibility.
- e. Respond to construction market conditions through sensitive evaluation of design decisions in terms of local labor, contractor, and material availability and the maintenance of design and contracting flexibility.
- f. Maintain previously-determined feasible and targeted funds for project completion including construction phase modifications.

#### KSC ESTIMATING SPECIFICATION REQUIREMENTS

The KSC cost estimating specification covers the basic elements of effective construction cost management for CoF projects and establishes uniform requirements and guidelines for their implementation. These elements are:

- a. Requirements and guidelines for uniform and timely compilation of CoF cost estimates.

- b. Definitions of terms commonly used in construction cost management communication.
- c. Value and cost engineering.
- d. The KSC Monthly Construction Cost Index.
- e. The KSC Abstract of Construction Bid Costs.
- f. The KSC Design Cost Study.

#### VALUE AND COST ENGINEERING

The cost estimating specification defines and requires the application of value and cost engineering from project concept stages through activation.

#### COST ENGINEERING

Cost engineering deals with control, management, and manipulation of costs pertaining to a single project. It involves quantity surveys, accounting, analyses, control management, estimating, depreciation, escalation, and all forms of cost applicable to the project.

#### VALUE ENGINEERING

Value engineering involves the systematic application of recognized techniques that identify the function(s) of a product or service, establish the worth of those functions, and provide them at the lowest costs possible within the limits of design reliability. Value engineers identify design ambiguities, omissions, discrepancies, material shortages, long-lead delivery times, and economics that will impact overall project budgets. The cost estimating specification assigns value engineering to cost estimators and requires that their findings and recommendations be forwarded in writing with estimates that they review. The estimators are also to identify.

- a. Costly materials that can be replaced with less expensive conventional materials.
- b. Unrealistic design requirements, practices, and methods.
- c. Unrealistic time schedules.
- d. Overdesign in terms of project requirements.
- e. All areas where costs of current design appear to be exceeding, without justification, the costs of existing and comparable facilities.

## THE KSC MONTHLY CONSTRUCTION COST INDEX

The index incorporates prices and price adjustments for the KSC location and specialized construction requirements. It informs estimators and engineers what the local labor and material costs are and how these costs change from month to month, using a base index of January 1974 prices.

One page in each publication of the index presents the status of labor and material costs from January, 1974, to the latest date of index publication.

The included material cost index page shows latest per-unit and job costs for materials typical in each SPECSINTACT division.

The labor cost portion of the index indicates current Department of Labor base wages for typical construction skills in cost per hour. Markups are also indicated.

Another part of this labor portion provides KSC-local base and markup rates for typical crews in trades and skills of SPECSINTACT divisions.

Phase II of the index provides marked-up labor and material costs per unit for construction systems typically occurring in each of the SPECSINTACT divisions.

## ABSTRACT OF CONSTRUCTION BID COSTS

The abstract provides a continuing record of NASA/KSC estimating performance. Government estimates are compared with all bids received for all projects.

The abstract is summarized on a quarterly basis. Positions of Government estimates relative to contractor bids are noted. Trends are identified and analyzed and required corrective actions are implemented. Established performance of an awarded contractor can be analyzed subsequent to bid award to determine if he underbid the job or assessed it correctly. Government estimates can be further evaluated in terms of the results of the analyses.

## DESIGN COST STUDY

This study provides a historical record of design costs associated with KSC CoF projects. It presents typical factors that contribute to design costs for each project.

The study is summarized quarterly. Costs per sheet and costs per manhour are averaged. Averaged design costs for in-house efforts and outside A&E firms are separated, averaged, and compared. Trends are identified and analyzed.

Information compiled in the study forms the basis for increasing the accuracy of estimating project design costs.

#### PRESENTATION CLOSEOUT

The KSC cost estimating specification is a baseline for standardizing estimating practices and methods around CoF experiences and anticipated needs. Its requirements are based on the real conditions existing in the construction industry, both nationwide and local to KSC.

Uniformity in cost estimating and presentation established by the specification will reduce the time required to review, evaluate, and approve cost estimates. Accuracy and completeness will improve. Design will improve because of an overall review of total design packages.

As a result, the Government will negotiate from a position of strength, budgets will be more accurate and realistic, facility designs will become more cost effective, and CoF projects will be controlled with effective construction cost management.





# FORM 3 (FOR TYPING)

## REQUIRED FOR TECHNICAL PROGRAM BROCHURE

s) KENNEDY SPACE CENTER, COST ENGINEERING FORMAT  
FOR SPACE SHUTTLE FACILITIES CONSTRUCTION MANAGEMENT

) JOSEPH ANDREW BROWN CCE

s) CONSULTANT CONSTRUCTION COST ENGINEER

NASA CONSTRUCTION COST ENGINEERING  
DESIGN ENGINEERING DIRECTORATE DD-FED-1  
NATIONAL AERONAUTICS & SPACE ADMINISTRATION  
KENNEDY SPACE CENTER, FLORIDA 32899

REPEAT  
 AS REQ.  
 FOR  
 MORE  
 THAN  
 ONE  
 AUTHOR.

5. Member Grade  
 (As applicable MEMBER AACE)

6. Abstract

(150 words max.)

Use 2nd sheet

as required. This presentation describes NASA Budget, PER's, Preliminary and Final Design (30, 60, 90, 100%) Cost Estimates, also Change Orders Cost Estimates. Its special features include one page unique summaries for (1) Labor & Material; (2) Systems and (3) Specialized (Aero-space) Construction Budget line items. It discusses basic concepts in construction cost management, cost engineering, value engineering, and the KSC Monthly Cost Index. The 60 viewgraphs of samples and descriptions serve as an orientation for NASA Management, Engineers, Designers, and Estimators. This method helps standardize the cost estimating procedures for construction management with over 370 KSC Design Engineers (DE), 900 PRC Support Contractor Engineers, Technicians, and 10 to 18 A&E Firms handling over 100 separate projects for Space Shuttle Facilities, Ground Support Equipment, and Payloads Receiving Check-out Launches. These Shuttle Facilities are for near space developments for mankind, such as communication satellites, manufacturing, energy management, and defense. This standardized format will reduce KSC reviews and approval time of cost estimates; reduce engineering design and redesign time; improve accuracy and credibility of estimates and strengthen the Government's negotiation position.

7. Include Photo (1'W X 1-1'5L)

8. Abbreviated title (6 words max.) for program schedule.

<u>KSC</u>	<u>ESTIMATING</u>	<u>FORMAT</u>	<u>FOR</u>	<u>CONSTRUCTION</u>	<u>MANAGEMENT</u>
1	2	3	4	5	6

AMERICAN ASSOCIATION OF COST ENGINEERS  
1977-21 AACE ANNUAL MEETING  
MILWAUKEE, WISCONSIN

Mr. Joseph A. Brown  
Construction Consultant Cost Engineer  
Design Engineering Directorate, DD-FED-1  
Kennedy Space Center, Florida 32899

SUBJECT: "KSC Estimating Format for C.M."

Kennedy Space Center Construction Cost Estimating Format  
for Space Shuttle Facilities Construction Management

Mr. Joseph A. Brown is presently employed as Construction Cost Engineer for the National Aeronautics & Space Administration's Design Engineering Directorate. In this capacity, he prepares and reviews Government and subcontractor's construction cost estimates amounting to over \$2 billion for design and construction economies. He evaluates, recommends, coordinates and provides technical management of design engineering projects to accommodate launch vehicles such as Saturn V and Saturn IB for the Apollo and ASTP programs. He is currently working on facility costs and requirements for future space exploration of such programs as the Space Station, Space Shuttle and Viking unmanned landing on Mars. Mr. Brown received his formal education at the University of Florida where his major study was Architectural and Structural Design, Estimating, Management, Supervision, and Methods & Materials. He received an "A of A" and a "BBC" Degree there. With the Government, Mr. Brown has completed courses in Management, Procurement, Contract Cost Management, and NASA PERT. He has received a state and county license for Construction Cost Engineering and is a Co-inventor of Precast Concrete Geodesic Domes. He has done consulting, estimating, quantity survey, and bidding for general and subcontractors for Commercial, Industrial, and Residential Complex Developers-Builders, covering Florida, Georgia, Alabama, and Walt Disney World's Contemporary Resort Hotel. Mr. Brown teaches courses in Civil Engineering Technology at Brevard Community College. He is the Past President and Charter Member of the Florida Section of American Association of Cost Engineers, AACE 1969 "Member of the Moment;" General Arrangements Chairman 1975 Annual Meeting, Society of American Military Engineers; Canaveral Post's "Engineer of the Year," 1973; and NASA/Kennedy Space Center's Nominee for "Federal Employee of the Year," 1972. In addition to writing five technical papers, in 1972 he was 1st Place Winner in two categories in technical writing competition sponsored by the Society of Communications, Central Florida Chapter for "Construction Cost Escalation and Labor Productivity - What we can do about it," which was presented at AACE, 1st International Symposium in Montreal, Canada.